

AD-A229 196

REPORT DOCUMENTATION PAGE

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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED	
		Final Report/1 Dec 88-30 Nov 89	
4. TITLE AND SUBTITLE (DRUIP) Nozzle Beam Deposited Diamondlike Carbon Films		5. FUNDING NUMBERS 61104D/3842/A6	
6. AUTHOR(S) Calvin W. Lowe		DTIC FILE COPY	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Hampton University Physics Department Hampton, VA 23668		8. PERFORMING ORGANIZATION REPORT NUMBER AFOSR-TP- 90 1135	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AFOSR/NP Bolling AFB DC 20332-6448		10. SPONSORING/MONITORING AGENCY REPORT NUMBER AFOSR-89-0196	
11. SUPPLEMENTARY NOTES		DTIC ELECTED NOV 16 1989 S B D	
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) It was attempted to deposit hard carbon films using the ionized cluster beam deposition method with organic materials. The principle idea was to have the organic molecules to decompose on impact with the substrate. A major problem involved the decomposition of organic starting material in the crucible. It was hoped to use lower crucible temperatures to reduce decomposition. Increased crucible temperatures were eventually used to increase the deposition rate. This resulted in more hydrogen in the chamber and the 50 L/s turbomolecular pump was unable to maintain a pressure below about 8×10^{-4} torr. Changes and experiments are being made, but to date the endeavor has been unsuccessful.			
14. SUBJECT TERMS ion composition, depositing beam, physical properties, diamondlike carbon films		15. NUMBER OF PAGES 22	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAR

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PR - Project
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Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

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Final Report

Grant AFOSR-89-0196

(DRUIP) Nozzle Beam Deposited Diamondlike Carbon Films

Principal Investigator
Calvin W. Lowe, Sc. D.
Principal Investigator

Hampton University
Physics Department
Hampton, VA 23668

We have attempted to deposit hard carbon films using the ionized cluster beam deposition method with organic materials. The principle idea was to have the organic molecules to decompose on impact with the substrate. To date, we have been unsuccessful in this endeavor. The difficulties encountered and our proposed solutions are detailed below.

A major problem involved the decomposition of our organic starting material in the crucible. This was anticipated from the beginning of the project. We hoped to use lower crucible temperatures to reduce decomposition. However, we eventually increased crucible temperatures to increase the deposition rate. This resulted in more hydrogen in the chamber and our 50 l/s turbomolecular pump was unable to maintain a pressure below about 8×10^{-4} torr.

The first order fix to this problem was to install a CTI cryotorr-100 cryopump. This increased the overall pumping speed by a factor of seven and allowed us to pump water at 1100 l/s and hydrogen at about 500 l/s. Neither water nor hydrogen could be pumped with the turbomolecular pump. This problem also revealed

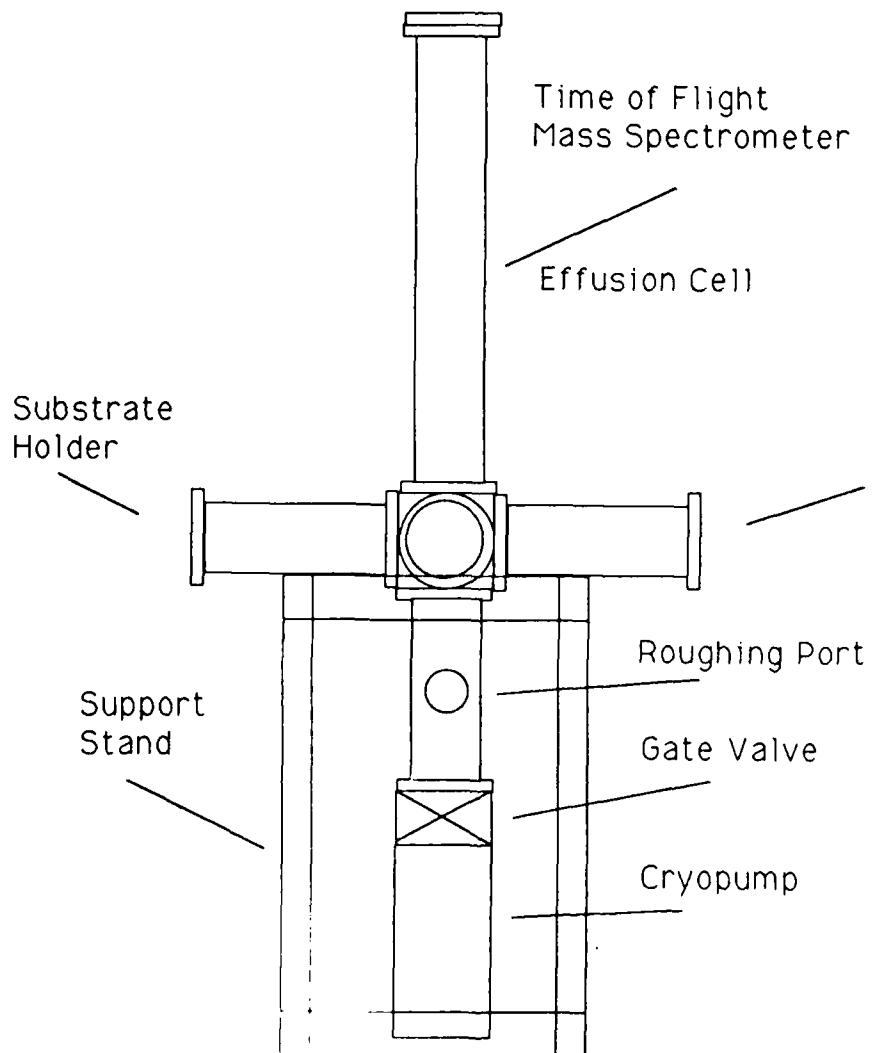


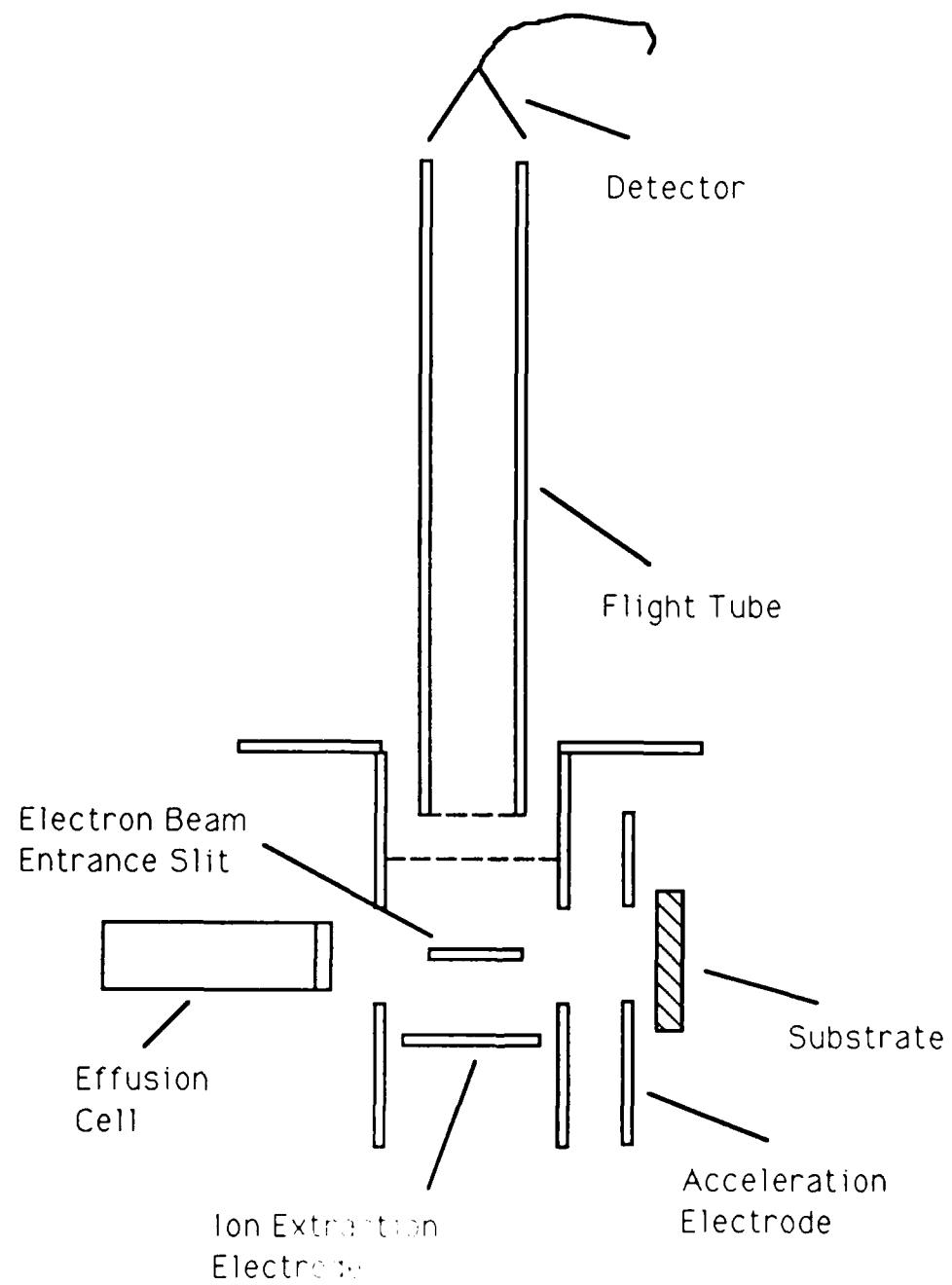
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some shortcomings of our ionized cluster beam source design.

Larger aperture nozzles were needed to increase the deposition rate with a minimal increase in the crucible temperature. We also found that varying the acceleration voltage did not have an appreciable affect on film growth. This was observed to be independent of the operating parameters of the ionization stage. As a result, we believe it likely that there are few ionized clusters in the beam. The source has been redesigned to move the ionization stage closer to the nozzle exit. The greater beam density at this location will allow more effective ionization to occur. We are also adapting a time of flight mass spectrometer to the station to carry out real time analysis of the ion composition and percentage of the depositing beam.

Drawings of the new source and vacuum chamber are attached. We are currently in the process of assembling the new station and hope to present some results at the American Physical Society meeting in Cincinnati, OH in March 1991. We have enlisted the aid of one undergraduate volunteer on this project and are currently seeking funding to extend the work into the area of optically nonlinear organic film growth and device fabrication.





AFOSR
Physics (Lowe-HASO)

1/217
January 12, 89

5-22350-520

Bertan Associates, Inc.

121 New South Road

Hicksville, NY 11801

1 ea IB-30 30kV ion beam power supply with
floating bias and filament power supplies

5 9 7 5 00

100

R. J. Lowe

Calvin W. Lowe

✓
January 12, 89

Physics (Lowe-A.FOSR)

5-23350-520

Insulator Seal, Inc.

P.O. Box 57016

Hayward, CA 94545

3	ea	601B0345-1 15 kV UHV-SHV feedthroughs	195	5 8 5 00
2	ea	601B1314-1 T.C. + Power UHV feedthrough	151	3 0 2 00
2	ea	601A0201-3 1 kV Weldable feedthrough	18	3 6 00
		TOTAL		9 2 3 00

Calvin W. Lowe

2/7
January 12, 85

Physics (Lowe-AFOSR)

5-22350-5

IMDC Vacuum Products Corp.

23342 Cabot Blvd

Page 1 of 3

Hayward, CA 94545-1551

4	ea	LN-133 LN ₂ -UHV feedthrough on 1 1/3" flange	125	5 0 0 00
1	ea	Custom 6" Flange w/7 miniflanges as per drawing		9 1 0 00
1	ea	Custom 6" Flange w/6 miniflanges as per drawing		8 1 5 00 <i>Refuse</i>
1	ea	BRM-133 Rotary motion feedthru on 1 1/3" flange		3 3 5 00
1	ea	CU 400-6 6 way cube w/6" flanges		2 5 0 0 00
1	ea	VP-400 Zero Profile Viewport		3 3 5 00
2	ea	F600000 6" Blank UHV Flange	65	1 6 8 00
3	ea	GK-400V Viton Gaskets	16	1 2 8 00
5	pkgs	BA-200 Bolt Sets	22	1 1 0 00

Calvin W. Lowe

January 12, 89

Physics (Lowe-AFOSR)

5-22350-520

MDC Vacuum Products Corp.

23842 Cabot Blvd.

Page 3 of 3

Hayward, CA 94545-1651

1	ea	600 x 275 6" to 2 3/4" adapter flange	1 0 0 00	100.00
1	ea	150X 2 3/4" flanged bellows	1 1 0 00	110.00
1	ea	K150 x 275 NW40 to 2 3/4" adapter flange	6 5 00	65.00
1	ea	K150-C NW40 Clamp	8 25	
1	ea	K150-CR NW40 Centering Ring	9 00	
1	ea	275 x 133 2 3/4" to 1 1/3" adapter flange	5 5 00	
1	ea	075 x 2 1 1/3" nipple	4 5 00	
15	ea	F133000 1 1/3" Coverplates	11.00	1 6 5 00
4	ea	BA-075 Bolt Sets	11	4 4 00

Cabin W. Lowe

January 12, 89

Physics (Lowe-AFOSR)

5-22350-520

MDC Vacuum Products Corp.

23842 Cabot Blvd.

Page 3 of 3

Hayward, CA 94545-1651

4	ea	GK-075V 1 1/3" Viton Gaskets	12	4 8 00	48.00
1	ea	BA-150 Bolt Set		1 3 00	13.00
4	ea	GK-100V Viton Gaskets	14	5 6 00	56.00
1	ea	3" UHV nipple		2 3 0 00	230.00

January 20, 39

Physics (Lowe-AFOSR)

5-22350-520

Production Supply Co. Inc of VA

600 Woodlake Drive

Chesapeake, VA

1	ea	4'x8'x1/8" Al Sheet	1 6 4 35
1	ea	4'x8'x $\frac{1}{8}$ " Al Sheet	3 2 2 00
25	ft	1"x1"x1/8" Al angle	3 2 00
12	ft	1" diameter Al bar	4 8 25
TOTAL			5 6 6 60

Calvin W. Lowe

January 27, 39

Physics (Lowe-AFOSR)

5-22350-520

OMEGA Engineering, Inc.

P.O. Box 4047

Stanford, CT 06907-0047

2	ea	CN300UKC Temperature Controller	199.00	3 9 8 00
10	ea	Bare-20-K-12 Type K Thermocouple	6.00	6 0 00
TOTAL				4 4 8 00

~~Rebiller~~
Rebiller

Calvin W. Lowe

HAMPTON UNIVERSITY
REQUISITION

ORDER NO. _____

TO: PURCHASING AGENT

DATE Feb. 21 19 89

ORDER FOR Physics (Lowe-AFOSR) DEPT.

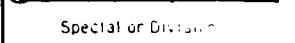
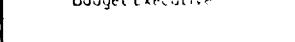
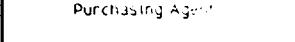
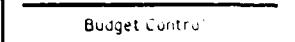
ACCOUNT NO. 5-22350-520

ORDER TO BE FILLED BY Kimball Physics Inc.

ADDRESS Kimball Hill Road

Wilton, NH 03086-9742

Page 1 of 2

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT				APPROVALS:
1	pkg	Al2O3-TU-C-500	17.00		1	7	.00	
2	pkg	Al2O3-TU-C-250	17.00		1	7	.00	
3	pkg	Al2O3-TU-C-125	17.00		1	7	.00	
2	pkg	Al2O3-SP-C-200	17.00		1	7	.00	
3	pkg	Al2O3-SP-C-025	17.00		1	7	.00	
3	pkg	Al2O3-SP-C-050	17.00		1	7	.00	
1	pkg	SS-WR-1500/031	17.00		1	7	.00	
6	pkg	SS-PL-C7X7-B	17.00		1	7	.00	
2	pkg	SS-PL-C7X7-R1500	17.00		1	7	.00	
2	pkg	SS-CY-1500/3000	17.00		1	7	.00	

PRODUCTION

JOB NO. _____

INSTRUCTION

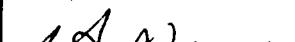
STOCK

ORDERED BY Calvin Lowe

Full Signature

PAGE 2 OF 2

Wilton, NH 03086-9742

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT				APPROVALS:
2	pkg	SS-LR-C	17.00		1	7	.00	
1	pkg	SS-MS-0-80/250	17.00		1	7	.00	
1	pkg	SS-MN-0-80	17.00		1	7	.00	
1	pkg	SS-CY-1500/1500	17.00		1	7	.00	
		TOTAL			5	1	0	.00

HAMPTON UNIVERSITY

REQUISITION

ORDER NO. _____

TO: PURCHASING AGENT

DATE March 9 19 89ORDER FOR Physics (Lowe-AFOSR) DEPT.ACCOUNT NO. 5-22350-522ORDER TO BE FILLED BY Priest Electronics, INC.ADDRESS 6431 Tidewater Drive
P. O. Box 7225
Norfolk, VA 23509-0225

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT			APPROVALS:
				1	0	0	
1	ea	SOLA 84-15-2110 solid power supply	87		8	7	.00
1	ea	Staco 1010 variable transformer	59		5	9	.00
4	ea	BUD SFA-1833 surface shield panel	10		3	8	.80
10	ea	GC 35-064 SPST toggle switch	1.50		1	5	.00
1	ea	44-234 BNC crimping tool	19.25		1	9	.25
		TOTAL			2	1	.05

PRODUCTION

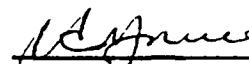
JOB NO. _____

INSTRUCTION STOCK

ORDERED BY

Cahri W. Lowe

Full Signature

 Special or Division Budget Executive Purchasing Agent Budget Control Business Manager

HAMPTON UNIVERSITY

REQUISITION

ORDER NO. _____

TO: PURCHASING AGENT

DATE March 8 19 89ORDER FOR Physics (Lowe-AFOSR) DEPT.ACCOUNT NO. 5-22350-522ORDER TO BE FILLED BY Small Parts INC.ADDRESS 6891 N. E. Third Ave.PO Box 381966Miami, FL 33238-1966

Page 1 of 3

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT			APPROVALS:
				1	2	9	
1	ea	C-CX-16-C 16 mesh SS wire cloth	29.50		2	9	.50
1	pkg	C-KWKC-2 1/8" cable ties 25/pkg	7.93			7	.93
1	pkg	C-KWKC-4 1/4" cable ties 25/pkg	9.03			9	.03
1	pkg	C-MX-080-2-B 1/8x0-80 SS screws	10.00		1	0	.00
1	pkg	C-MX-080-3-B 3/16x0-80 SS screws	10.00		1	0	.00
1	pkg	C-MX-080-4-B 1/4x0-80 SS screws	10.00		1	0	.00
1	pkg	C-MX-080-6-B 3/8x0-80 SS screws	16.25		1	6	.25
1	pkg	C-MX-080-8-B 1/2x0-80 SS screws	16.25		1	6	.25
1	pkg	C-MX-080-12-B 3/4x0-80 SS screws	16.25		1	6	.25
3	ea	C-TRX-080-24 24"x0-80 thread rod	10.00		3	0	.00

PRODUCTION

JOB NO. _____

INSTRUCTION STOCK

ORDERED BY _____

Calvin W. Lowe

Full Signature

Calvin W. LoweBudget ExecutivePurchasing AgentBudget ControlBusiness Manager

HAMPTON UNIVERSITY

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REQUISITION

TO: PURCHASING AGENT

DATE _____ 19 _____

ORDER FOR _____ DEPT. _____

ACCOUNT NO. _____

ORDER TO BE FILLED BY _____

ADDRESS _____

Page 2 of 3

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT			APPROVALS:
				1	2	3	
10	pkg	C-WX-0 size 0 SS flat washers 100/pkg	3.50		3	5	.00
3	pkg	C-HNX-080 0-80 SS nuts 100/pkg	7.35		2	2	.05
1	kit	C-ORBK-500 O-ring assortment kit	41.87		4	1	.87
1	ea	C-RP-1 angled retaining ring pliers	13.86		1	3	.86
2	ea	C-HM-906 inspection mirror	4.07			8	.14
2	ea	C-MT-10 carbide scribe	4.80			9	.60
1	ea	C-RUX-1 24" ruler w/ 1/64" markings	10.34		1	0	.34
4	ea	C-RUX-6 6" ruler w/ 1/32" markings	2.50		1	0	.00
2	ea	C-HM-204 wire prong holders	5.62		1	1	.24
1	set	C-TPS-28 transfer punch set-inch	59.33		5	9	.33

PRODUCTION

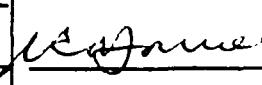
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INSTRUCTION STOCK ORDERED BY Cahill W. Lowe

Full Signature



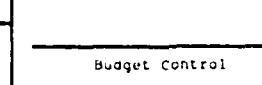
Special or Division



Budget Executive



Purchasing Agent



Budget Control



Business Manager

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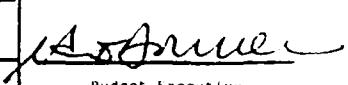
DATE 19 _____

ORDER FOR _____ DEPT.

ACCOUNT NO. _____

ORDER TO BE FILLED BY _____ ADDRESS _____

Page 3 of 3

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT				APPROVALS:
				2	3	.99	.60	
1	set	C-CP-1 7/8"x1.5" containers 100/set	23.99					
10	ea	C-RPT-12 24" x .75" plastic tubes	0.96			9	.60	
TOTAL				4	1	0	.23	
								 Special or Division
								 Budget Executive
								Purchasing Agent
								Budget Control
								Business Manager

PRODUCTION

JOB NO. _____

ORDERED BY _____


Cahin W. Law

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Full Signature

HAMPTON UNIVERSITY
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ORDER NO.

TO: PURCHASING AGENT

March 20, 89

ORDER FORM Physics (Lowe-AFOSR)

E 22250 530

ADDRESS P.O. Box 8146

11. *What is the name of the author of the book you are reading?*

Fredericksburg, VA 22401

11. *Leucosia* (Leucosia) *leucosia* (Linnaeus) (Fig. 11)

卷之三

PRODUCTION

1

JOB NO.

INSTRUCTION

1

STOCK

ORDERED BY

Calvin W. Cook

Full Signature

HAMPTON UNIVERSITY
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TO: PURCHASING AGENT

DATE 5/10 19 89

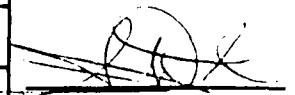
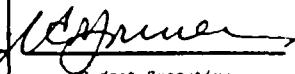
ORDER FOR Physics (Lowe-AFOSR) DEPT.

ACCOUNT NO. 5-22350-520

ORDER TO BE FILLED BY Precision Sales Company

ADDRESS 104 W. Joppa Road

Baltimore, MD 21204

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT				APPROVALS:
1	ea	model 125 power supply	2200	2	2	0	0	.00
1	ea	model THP tweezer hand piece	410	4	1	0	0	
1	ea	model PHP probe hand piece	375	3	7	5	.00	
TOTAL				2	9	8	5	.00

HAMPTON UNIVERSITY

REQUISITION

ORDER NO. _____

TO: PURCHASING AGENT

ORDER FOR Physics (Lowe-AFOSR) DEPT.

ORDER TO BE FILLED BY Klinger Scientific

DATE 5/16 1989

ACCOUNT NO. 5-22350-520

ADDRESS 999 Stewart Ave

Garden City, NY 11530

PRODUCTION

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Full Signature

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TO: PURCHASING AGENT

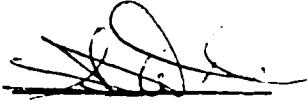
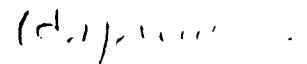
DATE June 5 19 89

ORDER FOR Physics (LOWE-AFOSR) DEPT.
ORDER TO BE FILLED BY Bertan Associates, Inc.

ACCOUNT NO. 5-22350-520

ADDRESS 121 New South Rd.

Hicksville, NY 11801

REQUEST QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT				APPROVALS:
				4	0	0	.00	
1	ea	High voltage cable for IB-30	400					 Special or Divisi. <u>Calvin W. Lowe</u>
		PIN-0221301-000						 Budget Executive
		TOTAL						 Purchasing Agent
								 Budget Control
								 Business Manager

PRODUCTION

JOB NO. _____

INSTRUCTION

STOCK

ORDERED BY Calvin W. Lowe

Full Signature

Purchasing Agent,

This cable is specially designed with a power supply we ordered from Bertan, Inc. Thus, we request a sole source purchase.

HAMPTON UNIVERSITY

REQUISITION

ORDER NO. _____

TO: PURCHASING AGENT

DATE June 5 1989

Physics (LOWE-AFOSR)

DEPT.

ORDER TO BE FILLED BY **National Instruments**

ACCOUNT NO. 5-22350-520

ADDRESS 12109 Technology Blvd.

Austin, TX 78727-6204

PRODUCTION

1

JOB NO.

INSTRUCTION

1

STOCK

ORDERED BY

Calvin W. Lowe

Full Signature

Purchasing Agent,

I request a sole source purchase of these items. We have previously bought from this company and the requested items are compatible with the existing equipment.

COPY

HAMPTON UNIVERSITY

REQUISITION

TO: PURCHASING AGENT

ORDER FOR **Physics (Lowe-NASA)**

DEPT.

ORDER FILLED BY **CTI-Cryogenics**

Attn: Order Processing

ADDRESS 266 Second Ave

DATE Nov 14, 1989

ENT NO. 5-22050-520

TOTAL \$9,900.00

PRODUCTION JOB NO.

INSTRUCTION STOCK

ORDERED BY

Full Signature